CLAIMS

1. An apparatus for thermally processing a microelectronic workpiece, comprising:

a workpiece support positioned to engage and support the microelectronic workpiece; and

a heat source having a solid engaging surface positioned to engage a surface of the microelectronic workpiece, the heat source further having a heat generator attached directly to and/or integral with the heat source, at least one of the heat source and the workpiece support being movable relative to the other between a first position with the microelectronic workpiece contacting the engaging surface of the heat source and a second position with the microelectronic workpiece spaced apart from the engaging surface, the heat source being sized to transfer heat to the microelectronic workpiece at least sufficient to thermally process a selected material of the microelectronic workpiece when the microelectronic workpiece is engaged with the heat source in the first position.

2. The apparatus of claim 1, further comprising:

a frame;

a first member fixed to the frame and supporting the heat source in a fixed position relative to the frame;

a first heat sink supported by the first member and movable relative to the first member between a first position with the first heat sink spaced apart from the heat source and a second position with the first heat sink engaged with the heat source;

a first actuator coupled between the lower member and the first heat sink to move the first heat sink relative to the lower member;

a second member fixed to the frame and supporting a cover, the cover being movable relative to the second member between a first position with the cover spaced apart from the first member and a second position with the cover engaged with the first member, the cover and the first member defining an at least partially enclosed chamber around the microelectronic workpiece when the cover is in the second position;

a second actuator coupled between the cover and the second member to move the cover between the first and second positions; and

a second heat sink fixed relative to the first member and coupled to a supply of cooling fluid, the second heat sink being engaged with the first heat sink when the first heat sink is in its second position.

3. The apparatus of claim 1 wherein the workpiece support is sized to support only a single microelectronic workpiece and the heat source is configured to contact no more than one microelectronic workpiece during a given processing cycle.

4. The apparatus of claim 1 wherein the heat source includes a vacuum aperture coupleable to a vacuum source and facing the microelectronic workpiece when the microelectronic workpiece is engaged with the workpiece support to draw the microelectronic workpiece toward the heat source.

5. The apparatus of claim 1, further comprising a purge fluid channel having an inlet coupleable to a source of purge fluid and an outlet proximate to the workpiece support, the purge fluid channel being positioned to conduct the purge fluid from the source of purge fluid to a region adjacent to the microelectronic workpiece when the microelectronic workpiece is supported by the workpiece support.

6. The apparatus of claim 1 wherein the heat source includes an electrical resistance heater.

7. The apparatus of claim 1, further comprising first and second heat sinks with the second heat sink spaced apart from the heat source and coupled to a supply of cooling fluid and the first heat sink positioned between the second heat sink and the heat source, the heat sink being movable relative to the cooling member between a first position with the first heat sink engaged with the second heat sink to cool the first heat sink, and a second position with the first heat sink engaged with the heat source to cool the heat source and the microelectronic workpiece when the microelectronic workpiece is engaged with the heat source.

8. The apparatus of claim 1, further comprising first and second heat sinks with the second heat sink spaced apart from the heat source and coupled to a supply of cooling fluid, the second heat sink further having an engaging surface with vacuum apertures coupled to a vacuum source and the first heat sink positioned between the second heat sink and the heat source, the first heat sink being movable relative to the second heat sink between a first position and a second position, the first heat sink being engaged with the engaging surface of the second heat sink to cover the vacuum apertures and cool the first heat sink when the first heat sink is in the first position, the first heat sink being engaged with the heat source to cool the heat source and the microelectronic workpiece when the microelectronic workpiece is engaged with the heat source and the first heat sink is in the second position.

9. The apparatus of claim 1 wherein the heat source has an electrical resistance element with a contact portion, and wherein the apparatus further comprises an electrically and thermally conductive connector having a first end and a second end opposite the first end, the connector being engaged with the contact portion of the electrical resistance element toward the first end of the connector, the connector being coupleable to a source of electrical current toward the second end of the connector, a cross-sectional area distribution of the connector between the first and second ends and transverse to a flow of electrical current through the connector being sized to generate electrical resistance heating at least equal to a loss of heat through the connector by thermal conduction.

10. The apparatus of claim 1 wherein the heat source has a first region configured to transfer heat to the microelectronic workpiece a first rate per unit area of the microelectronic workpiece, the heat source further having a second region configured to transfer heat to the microelectronic workpiece at a second rate per unit area of the microelectronic workpiece, the second rate per unit area being greater than the first rate per unit area.

11. The apparatus of claim 1, further comprising the microelectronic workpiece.

12. The apparatus of claim 1 wherein the heat source is sized to transfer heat to the microelectronic workpiece at a rate sufficient to anneal the selected material of the microelectronic workpiece.

13. The apparatus of claim 1 wherein the selected material includes solder and wherein the heat source is sized to transfer heat to the microelectronic workpiece at a rate sufficient to reflow the solder.

14. The apparatus of claim 1 wherein the selected material includes photoresist and wherein the heat source is sized to transfer heat to the microelectronic workpiece at a rate sufficient to cure and/or bake the photoresist.

15. An apparatus for thermally processing at least first and second microelectronic workpieces, comprising:

a first thermal processing chamber having a first workpiece support positioned to engage and support the first microelectronic workpiece, the first chamber further having a first heat source sized to transfer to the first microelectronic workpiece heat sufficient to thermally process the first microelectronic workpiece when the first microelectronic workpiece is at least proximate to the first heat source; and

a second thermal processing chamber proximate to the first chamber and having a second workpiece support positioned to engage and support the second microelectronic workpiece, the second chamber further having a second heat source sized to transfer to the second microelectronic workpiece heat sufficient to thermally process the second microelectronic workpiece when the second microelectronic workpiece is at least proximate to the second heat source, and with the first chamber positioned relative to the second chamber such that a portion of the first chamber between the first and second chambers is common to the second chamber.

16. The apparatus of claim 15 wherein the first chamber is positioned above the second chamber and wherein the portion common to the first and second chambers defines a lower surface of the first chamber and an upper surface of the second chamber.

17. The apparatus of claim 15 wherein the first workpiece support is movable relative to the first heat source between a first position and a second position, and further wherein the first heat source includes a solid engaging surface engaged with the first microelectronic workpiece when the workpiece support is in the first position, the solid engaging surface being spaced apart from the first microelectronic workpiece when the workpiece support is in the second position, and wherein the apparatus further comprises a heat sink beneath the heat source.

18. The apparatus of claim 15 wherein the first chamber includes a purge gas channel positioned to supply purge gas to the second chamber.

19. The apparatus of claim 15 wherein the first chamber and the second chamber are modular and interchangeable.

20. The apparatus of claim 15 wherein the first chamber includes a first lid movable between an open position to receive the first microelectronic workpiece and a closed position to at least partially enclose the first microelectronic workpiece, and further wherein the second chamber includes a second lid movable between an open position to receive the second microelectronic workpiece and a closed position to at least partially enclose the second microelectronic workpiece, and wherein the apparatus further comprises a base member supporting the first heat source, with the second lid interengaged with and depending from the base member.

21. The apparatus of claim 15 wherein the first workpiece support is sized to support no more than one microelectronic workpiece at a time and the first heat source is sized to contact no more than one microelectronic workpiece at a time.

22. The apparatus of claim 15, further comprising first and second heat sinks with the second heat sink spaced apart from the first heat source and coupled to a supply of cooling fluid and the first heat sink positioned between the second heat sink and the first heat source, the first heat sink being movable relative to the second heat sink

between a first position with the first heat sink engaged with the second heat sink to cool the first heat sink, and a second position with the first heat sink engaged with the first heat source to cool the heat source and the first microelectronic workpiece when the first microelectronic workpiece is engaged with the first workpiece support.

23. An apparatus for thermal processing a microelectronic workpiece, comprising:

an apparatus support;

a heat source supported by the apparatus support;

a workpiece support positioned proximate to the heat source to engage and support the microelectronic workpiece relative to the heat source; and

a heat sink proximate to the heat source and positioned to selectively transfer heat from the heat source to cool the heat source and the microelectronic workpiece.

24. The apparatus of claim 23 wherein the workpiece support is movable relative to the heat source between a first position with the microelectronic workpiece contacting the heat source and a second position with the microelectronic workpiece spaced apart from the heat source.

25. The apparatus of claim 23 wherein the heat sink includes a passive conduction heat sink having no cooling fluid links coupled thereto.

26. The apparatus of claim 23 wherein at least one of the heat sink and the heat source is movable relative to the other between an engaged position with the heat sink engaged with the heat source and a disengaged position with the heat sink spaced apart from the heat source.

27. The apparatus of claim 23 wherein the heat sink is a first heat sink and the engaged position is a first engaged position, and wherein the apparatus further comprises a second heat sink spaced apart from the first heat sink and coupled to a supply of cooling fluid, and wherein the first heat sink is positioned between the second heat sink and the heat source, the first heat sink being movable relative to the second heat sink between the first

engaged position with the first heat sink engaged with the heat source and a second engaged position with the first heat sink engaged with the second heat sink to cool the first heat sink.

28. The apparatus of claim 23 wherein a thermal mass of the heat sink exceeds a thermal mass of the heat source.

29. The apparatus of claim 23 wherein a thermal capacity of the heat sink exceeds a thermal capacity of the heat source.

30. The apparatus of claim 23 wherein the workpiece support is sized to support no more than one microelectronic workpiece at a time and the heat source is sized to contact no more than one microelectronic workpiece at a time.

31. The apparatus of claim 23 wherein the heat source includes a vacuum aperture coupleable to a vacuum source and facing the microelectronic workpiece when the microelectronic workpiece is engaged with the workpiece support to draw the microelectronic workpiece toward the heat source.

32. The apparatus of claim 23 wherein the heat sink has an engaging surface that is compressible between an uncompressed configuration when the heat sink is disengaged from the heat source and a compressed configuration when the heat sink is engaged with the heat source.

33. An apparatus for thermal processing a microelectronic workpiece, comprising:

a workpiece support positioned to engage and support the microelectronic workpiece;

a heat source having an electrical resistance element and an electrical contact portion, the heat source being configured to transfer heat to the microelectronic workpiece at a rate sufficient to thermally process the microelectronic workpiece when the microelectronic workpiece is at least proximate to the heat source; and

an electrically and thermally conductive connector having a first end and a second end opposite the first end, the connector being engaged with the contact portion of the electrical resistance element toward the first end of the connector, the connector being coupleable to a source of electrical current toward the second end of the connector, a cross-sectional area distribution of the connector between the first and second ends and transverse to a flow of electrical current through the connector being sized to generate electrical resistance heating at least equal to a loss of heat through the connector by thermal conduction.

34. The apparatus of claim 33 wherein the connector has an at least partially conical shape with a larger diameter toward the first end than toward the second end, further wherein an outer edge of the connector is curved in a plane parallel to an axis extending between the first end second ends.

35. The apparatus of claim 33 wherein the electrical terminal portion is positioned proximate to an outer edge of the microelectronic workpiece when the microelectronic workpiece is positioned on the workpiece support.

36. The apparatus of claim 33 wherein at least one of the heat source and the workpiece support is movable relative to the other between a first position with the microelectronic workpiece contacting the engaging surface of the heat source and a second position with the microelectronic workpiece spaced apart from the engaging surface.

37. The apparatus of claim 33, further comprising:

a base member supporting the heat source; and

a lid movable relative to the base member between an open position and a closed position with the lid and the base member positioned to receive the microelectronic workpiece therebetween when the lid is in the open position, the lid and the base member at least partially enclosing the microelectronic workpiece when the lid is in the closed position.

38. The apparatus of claim 33 wherein the heat source is sized to transfer sufficient heat to the microelectronic workpiece to anneal a selected material of the

microelectronic workpiece when the microelectronic workpiece is at least proximate to the heat source.

39. The apparatus of claim 33, further comprising the microelectronic workpiece.

40. An apparatus for thermally processing a microelectronic workpiece, comprising:

a workpiece support configured to support the microelectronic workpiece; and

a heat source positioned proximate to the workpiece support and having a first region configured to transfer heat to the microelectronic workpiece at a first rate per unit area of the microelectronic workpiece, the heat source further having a second region configured to transfer heat to the microelectronic workpiece at a second rate per unit area of the microelectronic workpiece, the second rate per unit area being greater than the first rate per unit area.

41. The apparatus of claim 40 wherein at least one of the workpiece support and the heat source is movable relative to the other between a first position with the heat source engaged with the microelectronic workpiece to transfer heat to and/or from the microelectronic workpiece and a second position with the heat source spaced apart from the microelectronic workpiece.

42. The apparatus of claim 40 wherein the microelectronic workpiece includes an outer region and an inner region disposed inwardly from the outer region, and further wherein the first region of the heat source is aligned with the inner region of the microelectronic workpiece and the second region of the heat source is aligned with the outer region of the microelectronic workpiece when the microelectronic workpiece is supported by the workpiece support.

43. The apparatus of claim 40, further comprising:

first and second electrical resistance heaters positioned to supply heat to the first region; and

third and fourth electrical resistance heaters positioned to supply heat to the second region.

44. The apparatus of claim 40 wherein the heat source is generally circular and has a center and a radius, further wherein the first region is disposed radially inwardly from the second region and wherein the second rate per unit area is a fraction of about 7.5% greater than the first rate per unit area, the fraction corresponding to the quotient of the distance of the second region from the center of the heat source divided by the radius of the heat source.

45. The apparatus of claim 40 wherein the heat source is generally circular and has a radius and a center, further wherein a power generated by the heat source per unit area of the microelectronic substrate increases gradually in a radial direction outward from the center over at least a portion of the heat source.

46. The apparatus of claim 40 wherein the heat source has an outer edge and an inner region inward of the outer edge and further wherein a power generated by the heat source per unit area of the microelectronic substrate increases gradually in a radial direction inwardly from the outer edge over at least a portion of the heat source

47. The apparatus of claim 40 wherein the heat source includes at least one electrical resistance element having a contact region for coupling to a source of electrical power, further wherein the second region is positioned closer to the contact region than is the first region.

48. The apparatus of claim 40 wherein the heat source is generally circular and includes an elongated electrical resistance heater having a generally constant cross-sectional area, and wherein at least a portion of the heater is doubled back on itself to extend along a plurality of spaced apart circumferential lines in both the first region and the second region, circumferential lines in the first region being spaced apart from each other by a first distance, circumferential lines in the second region being spaced apart by a second distance less than the first distance.

49. The apparatus of claim 40 wherein the heat source includes a substrate having a substrate surface area and an electrical resistance heater adjacent to the substrate and having a heater resistance surface area, the resistance heater surface area being approximately 67% of the substrate surface area.

50. The apparatus of claim 40 wherein the heat source includes a first electrical resistance heater in the first region coupled to a first controller and a second electrical resistance heater in the second region coupled to a second controller, the first and second controllers being independently controllable to provide power to the first region independent of power provided to the second region.

51. An apparatus for thermally processing a microelectronic workpiece, comprising:

a workpiece support positioned to engage and support the microelectronic substrate;

a heat source positioned at least proximate to the workpiece support;

a first heat sink positioned at least proximate to the heat source to cool the heat source; and

a second heat sink positioned at least proximate to the first heat sink to cool the first heat sink.

52. The apparatus of claim 51 wherein the first heat sink is moveable relative to the heat source and the second heat sink between a first position with the first heat sink engaged with the heat source to cool the heat source and a second position with the first heat sink engaged with the second heat sink to cool the first heat sink.

53. The apparatus of claim 51 wherein the heat source is positioned above the first heat sink.

54. The apparatus of claim 51 wherein the workpiece support is moveable between an engaged position with the microelectronic workpiece engaged with the heat

source, and a disengaged position with the microelectronic workpiece disengaged from the heat source.

55. The apparatus of claim 51, further comprising the microelectronic workpiece.

56. An apparatus for annealing a microelectronic workpiece, comprising:

an apparatus support;

a base fixed relative to the apparatus support;

a lid positioned proximate to the base and movable relative to the base between an open position to receive the microelectronic workpiece and a closed position, with the lid and the base defining an annealing chamber when the lid is in the closed position;

a workpiece support positioned between the lid and the base to engage and support the microelectronic workpiece;

a heat source fixed relative to the base;

a first heat sink movable relative to the heat source between a first position with the first heat sink contacting the heat source, and a second position with the first heat sink spaced apart from the heat source; and

a second heat sink fixed relative to the base and having an engaging surface positioned to engage the first heat sink to transfer heat from the first heat sink when the first heat sink is in the second position.

57. The apparatus of claim 56, further comprising:

a first bellows actuator connected to the lid and coupled to a source of pressurized fluid to move the lid between the open position and the closed position; and

a second bellows actuator connected to the first heat sink and coupled to the source of pressurized fluid to move the first heat sink between the engaged position and the disengaged position.

58. A method for thermally processing a microelectronic workpiece, comprising:

engaging the microelectronic workpiece with a solid heat transfer surface of a heat source;

directing heat into the heat source with a heat generator attached directly to and/or integral with the heat source;

transferring sufficient heat from the solid surface to the microelectronic workpiece to thermally process a selected material of the microelectronic workpiece; and

disengaging the microelectronic workpiece from the solid surface.

59. The method of claim 58, further comprising at least partially enclosing the microelectronic workpiece by engaging a lid positioned proximate to one side of the microelectronic workpiece with a base supporting the solid heat transfer surface and positioned proximate to an opposite side of the microelectronic workpiece, with the microelectronic workpiece positioned between the lid and the base.

60. The method of claim 58, further comprising cooling the microelectronic workpiece.

61. The method of claim 58, further comprising cooling the microelectronic workpiece by engaging a heat sink with the heat source while the heat source is engaged with the microelectronic workpiece.

62. The method of claim 58 wherein the heat sink includes a compressible surface and wherein engaging the heat sink with the heat source includes engaging the compressible surface of the heat sink with the heat source and compressing the compressible surface from an uncompressed configuration to a compressed configuration.

63. The method of claim 58, further comprising:

cooling the microelectronic workpiece by engaging a first heat sink with the heat source while the heat source is engaged with the microelectronic workpiece; and

cooling the first heat sink by engaging the first heat sink with a second heat sink and supplying cooling liquid to the second heat sink.

64. The method of claim 58 wherein the microelectronic workpiece is one of a plurality of microelectronic workpieces, further comprising engaging one microelectronic workpiece at a time with the heat source.

65. The method of claim 58, further comprising drawing the microelectronic workpiece into engagement with the heat transfer surface by applying a vacuum to the microelectronic workpiece.

66. The method of claim 58, further comprising purging a region adjacent to the microelectronic workpiece of oxidizing agents by supplying a purge fluid to the region.

67. The method of claim 58, further comprising heating the solid heat transfer surface with an electrical resistance heater.

68. The method of claim 58, further comprising:

heating the solid heat transfer surface with an electrical resistance heater; and

offsetting a conductive heat loss at a connection terminal of the heater by sizing a connector attached to the terminal to generate electrical resistance heat.

69. The method of claim 58, further comprising:

transferring heat to a first region of the microelectronic workpiece at a first rate per unit area of the microelectronic workpiece; and

transferring heat to a second region of the microelectronic workpiece at a second rate per unit area of the microelectronic workpiece, the second rate per unit area being greater than the first rate per unit area.

70. The method of claim 58 wherein transferring heat from the solid surface includes transferring heat at a rate sufficient to anneal the selected material.

71. The method of claim 58 wherein the selected material includes solder and wherein transferring heat from the solid surface includes transferring heat at a rate sufficient to reflow the solder.

72. The method of claim 58 wherein the selected material includes photoresist and wherein transferring heat from the solid surface includes transferring heat at a rate sufficient to cure and/or bake the photoresist.

73. The method of claim 58 wherein the selected material includes copper and wherein transferring heat to the microelectronic workpiece includes heating the microelectronic workpiece to a temperature of from about 210 degrees Celsius to about 290 degrees Celsius for a period of from about 30 seconds to about 90 seconds.

74. The method of claim 58 wherein thermally processing the selected material includes thermally annealing a metal layer electrochemically-deposited on the microelectronic workpiece.

75. The method of claim 58 wherein thermally processing the selected material includes thermally annealing a metal layer electrolytically-deposited on the microelectronic workpiece.

76. The method of claim wherein thermally processing the selected material includes thermally annealing a copper layer electrochemically-deposited on the microelectronic workpiece.

77. The method of claim 58 wherein thermally processing the selected material includes thermally annealing a copper layer electrolytically-deposited on the microelectronic workpiece.

78. A method for forming a plurality of chambers for thermally processing a microelectronic workpiece, comprising:

providing a first thermal processing chamber having a first portion, a second portion proximate to the first portion, and a first cavity between the first portion and the second portion, the first cavity being configured to receive a single microelectronic workpiece;

disposing a first heat source in the first cavity;

positioning a third portion proximate to the second portion with the second and third portions together defining a second cavity therebetween configured to receive another single microelectronic workpiece; and

disposing a second heat source in the second cavity.

79. The method of claim 78, further comprising positioning the second portion beneath the first portion and positioning the third portion beneath the second portion.

80. The method of claim 78, further comprising:

disposing a first workpiece support in the first cavity, the first workpiece support being movable relative to the first heat source to removably engage a first microelectronic workpiece with the first heat source; and

disposing a second workpiece support in the second cavity, the second workpiece support being movable relative to the second heat source to removably engage a second microelectronic workpiece with the second heat source.

81. A method for thermally processing a microelectronic workpiece, comprising:

supporting the microelectronic workpiece relative to a heat source;

transferring heat from the heat source to the microelectronic workpiece; and

selectively transferring heat from the heat source to a heat sink to cool the heat source and the microelectronic workpiece while the microelectronic workpiece is supported relative to the heat source.

82. The method of claim 81, further comprising moving at least one of the microelectronic workpiece and the heat source relative to the other to transfer heat from the heat source to the microelectronic substrate.

83. The method of claim 81, further comprising moving the heat sink relative to the heat source from a disengaged position to an engaged position with the heat sink contacting the heat source when the heat sink is in the engaged position to transfer heat from the heat source and the microelectronic workpiece.

84. The method of claim 81 wherein the heat sink is a first heat sink and wherein the method further comprises:

transferring heat from the first heat sink to a second heat sink by moving the first heat sink away from the heat source and proximate to a second heat sink; and

transferring heat away from the second heat sink.

85. The method of claim 81 wherein transferring heat from the heat source to the heat sink includes transferring heat without transferring cooling fluid to the heat sink.

86. The method of claim 81 wherein the heat sink is a first heat sink and wherein the method, further comprises:

transferring heat from the first heat sink to a second heat sink by moving the first heat sink away from the heat source and into engagement with a second heat sink; and

transferring heat away from the second heat sink by supplying cooling fluid to the second heat sink.

87. The method of claim 81 wherein supporting the microelectronic workpiece includes supporting no more than one microelectronic workpiece at a time with a single workpiece support.

88. The method of claim 81, further comprising drawing a vacuum through apertures in the heat source to bias the microelectronic workpiece toward the heat source.

89. A method for thermally processing a microelectronic workpiece, comprising:

positioning the microelectronic workpiece proximate to a heat source

providing heat to a first region of the heat source at a first rate per unit area of the microelectronic workpiece; and

providing heat to a second region of the heat source at a second rate per unit area of the microelectronic workpiece, the second rate per unit area being greater than the first rate per unit area.

90. The method of claim 89, further comprising heating the microelectronic workpiece to a generally uniform temperature.

91. The method of claim 89, further comprising heating the microelectronic workpiece to a selected steady state temperature having a range over a surface of the microelectronic workpiece of from about 3 degrees Celsius to about 4 degrees Celsius.

92. The method of claim 89 wherein the heat source is generally circular and has a center and a radius, further wherein the first region is disposed radially inwardly from the second region and wherein the providing heat at the second rate per unit area includes providing heat at a fraction of about 7.5% greater than the first rate per unit area, the fraction corresponding to the quotient of the distance of the second region from the center of the heat source divided by the radius of the heat source.

93. The method of claim 89 wherein the heat source is generally circular and has a radius and a center, and wherein the method further comprises generating power with the heat source at a rate per unit area of the microelectronic substrate and/or the heat source that increases gradually in a radial direction outward from the center over at least a portion of the heat source.

94. The method of claim 89 wherein the heat source has an outer edge and an inner region inward of the outer edge and wherein the method further comprises

generating power with the heat source at a rate per unit area of the microelectronic substrate and/or the heat source that increases gradually in a radial direction inwardly from the outer edge over at least a portion of the heat source

95. The method of claim 89 wherein the heat source includes at least one electrical resistance element having a contact region for coupling to a source of electrical power, further wherein providing heat to the second region includes providing heat to the heat source proximate to the contact region.

96. The method of claim 89, further comprising controlling power supplied to the first region of the heat source independently of controlling power supplied to the second region.

97. A method for thermally processing a microelectronic workpiece, comprising:

positioning the microelectronic workpiece at least proximate to a heat source;

transferring sufficient heat from the heat source to the microelectronic workpiece to thermally process a selected material of the microelectronic workpiece;

positioning a first heat sink at least proximate to the heat source to cool the heat source and the microelectronic workpiece; and

positioning the first heat sink at least proximate to a second heat sink to cool the first heat sink.

98. The method of claim 97 wherein positioning the microelectronic workpiece includes engaging the microelectronic workpiece with the heat source.

99. The method of claim 97 wherein positioning the first heat sink at least proximate to the heat source includes engaging the first heat sink with the heat source.

100. The method of claim 97 wherein positioning the first heat sink at least proximate to the second heat sink includes engaging the first heat sink with the second heat sink.

101. The method of claim 97, further comprising moving the first heat sink downwardly from the heat source to the second heat sink.